

# Ear, Cheek, Head and Torso Simulators A14

Accessories of the KLIPPEL ANALYZER SYSTEM (Document Revision 1.8)

Acoustical headphone and headset testing requires dedicated simulators and test jigs according to different standards. The following selection gives an overview on different kinds of simulators which are compatible to the KLIPPEL Analyzer System. The listed sets are all equipped with IEPE standard conform constant current supply (CCP) mic preamplifiers, which can directly be connected to the Klippel measurement devices. All sets are complete with cables and accessories, ready to use with Klippel measurement devices. Hints are given for selecting a certain simulator for different applications. Other version e.g., with 200 V polarized microphones or other options are available on request.

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## 1 Ear Simulator Kits

### 1.1 G.R.A.S. 43AC-S5 Ear Simulator Kit, HF Variant

#### Single Channel (Mono) Ear Simulator Kit for In-Ear Headphones

Item Number: 2400-095

This is a complete test jig for acoustical measurements on earphones coupled to the ear by inserts such as tubes and ear molds in accordance with:

- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 (08/96)

Specification:

- Bandwidth:  
100 Hz to 10 kHz according to IEC 60318-4,  
10 to 20 kHz  $\pm$  2.2 dB test tolerance
- Sensitivity: 12 mV/Pa
- Mic cartridge diameter: ½"

Including:

- G.R.A.S. RA0402 Ear Simulator  
(G.R.A.S. 40AO Mic incl. in RA0402)
- G.R.A.S. 26CB ¼" IEPE Preamplifier
- G.R.A.S. RA0001 Right-angled Adapter
- G.R.A.S. RA0052 Test Jig
- G.R.A.S. AA0070 3m BNC-Microdot cable



Suitable for RnD and QC applications

- Defined and reproducible positioning of the DUT is ensured by the coupler and adjustable spring-loaded arm.
- Testing stereo earphones in one QC sequence requires two sets.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Alternatives – based on same fixture type 43AC (on request):

- G.R.A.S. 43AC or 43AC-S1 Ear Simulator Kit according to IEC 60318-4
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation  $\leq$  10 kHz
- G.R.A.S. 43AC-6 or 43AC-S7 Ear Simulator Kit, High-Resolution variant
  - Advantage: bandwidth increased  $\leq$  50 kHz
  - Disadvantage: increased noise level due to smaller mic cartridge with reduced sensitivity
- G.R.A.S. 43AC, 43AC-S4 or 43AC-S6 Ear Simulator Kits with 200 V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

**1.2 G.R.A.S. 43AA-S2 Ear Simulator Kit according to IEC 60318-1 & -2**

Single Channel (Mono) Ear Simulator Kit for On-Ear (supra-aural) and Over-Ear (circum-aural) Headphones

Item Number: 2400-075

A complete test jig for acoustical measurements on earphones and telephone handsets in accordance with:

- IEC 60318-1 & -2 (former IEC 60318)
- ITU-T Rec. P.57 (08/96)

Specification:

- Bandwidth:  $\leq 10$  kHz (accord. to standard)
- Bandwidth:  $\leq 20$  kHz (mic limit)
- Sensitivity: 12 mV/Pa
- Mic cartridge diameter:  $\frac{1}{2}$ "

Including:

- G.R.A.S. RA0052 Test Jig
- G.R.A.S. RA0039 Ear Simulator
- G.R.A.S. 40AO  $\frac{1}{2}$ " IEPE Microphone
- G.R.A.S. 26CB  $\frac{1}{4}$ " IEPE Preamplifier
- G.R.A.S. RA0001 Right-angled Adapter
- G.R.A.S. AA0070 3m BNC-Microdot cable



Suitable for RnD and QC applications

- Defined and reproducible positioning of the DUT is ensured by the coupler and adjustable spring-loaded arm.
- Testing stereo earphones in one QC sequence requires two sets.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Alternatives – based on same fixture type 43AA (on request):

- G.R.A.S. 43AA or 43AA-S3 Ear Simulator Kits with 200 V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

## 2 Ear & Cheek Simulator Kits with Pinna

### 2.1 G.R.A.S. 43AG-7 Ear & Cheek Simulator Kit with Pinna, HF Variant

#### Single Channel (Mono) Ear & Cheek Simulator Kit for earphones of various types

Item Number: 2400-064

A complete test jig for acoustical measurements on earphones of various types in accordance with:

- IEC 60959
- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 2 Artificial Ear
- ITU-T Rec. P.57 Type 3.3 Pinna Simulator

Including:

- G.R.A.S. RA0052 Test Jig
- G.R.A.S. RA0402 Ear Simulator (G.R.A.S. 40AO Mic incl. in RA0402)
- G.R.A.S. 26CB ¼" IEPE Preamp
- G.R.A.S. RA0314 Cheek Plate
- G.R.A.S. RA0199 Finger Simulator
- G.R.A.S. KB5000 Large Right Anthropometric Pinna, Shore 35-00 (Optional left, small or harder pinna available on request)
- G.R.A.S. RA0001 Right-angled Adapter
- G.R.A.S. AA0070 3m BNC-Microdot cable



Specification:

- Bandwidth:  $\leq 20$  kHz
- Sensitivity: 12.5 mV/Pa
- Mic cartridge diameter: ½"

Suitable for RnD and QC application

- Recommended for RnD use only, as defined and reproducible positioning of the DUT has to be ensured by the user. A reproducible position on or in a pinna simulator is more complicated as on ear simulators.
- If the properties of the left and right earphones require testing on a left and right pinna, two sets with left and right pinna are needed or the pinna has to be exchanged for left and right testing.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Alternatives – based on same fixture type 43AG (on request):

- G.R.A.S. 43AG-1 or 43AG-2 Ear & Cheek Simulator Kit with Pinna
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
  - Disadvantage: previous version without softer, anthropometric pinna
- G.R.A.S. 43AG-3 or 43AG-4 Ear & Cheek Simulator Kit with Anthropometric Pinna
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
- G.R.A.S. 43AG-5 Ear & Cheek Simulator Kit with Pinna, Low Noise variant
  - Advantage: lowest possible noise floor
  - Disadvantage: bandwidth reduced to 10 kHz
- G.R.A.S. 43AG-8 or 43AG-9 Ear & Cheek Simulator Kit with Pinna, High Resolution variant
  - Advantage: bandwidth increased to 50 kHz
  - Disadvantage: increased noise level due to smaller mic cartridge with reduced sensitivity
- G.R.A.S. 43AG1, 43AG-3, 43AG-5, 43AG-6 or 43AG-8 Ear & Cheek Simulator Kits with 200V polar. mics
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

### 3 Headphone & Headset Test Fixtures

#### 3.1 G.R.A.S. 45CC-2 Headphone Test Fixture

Two Channel (Stereo) Test Fixture for On-Ear (supra-aural) and Over-Ear (circum-aural) Headphones

Item Number: 2400-079

A complete test jig for acoustical measurements for on-ear headphones.

Specification:

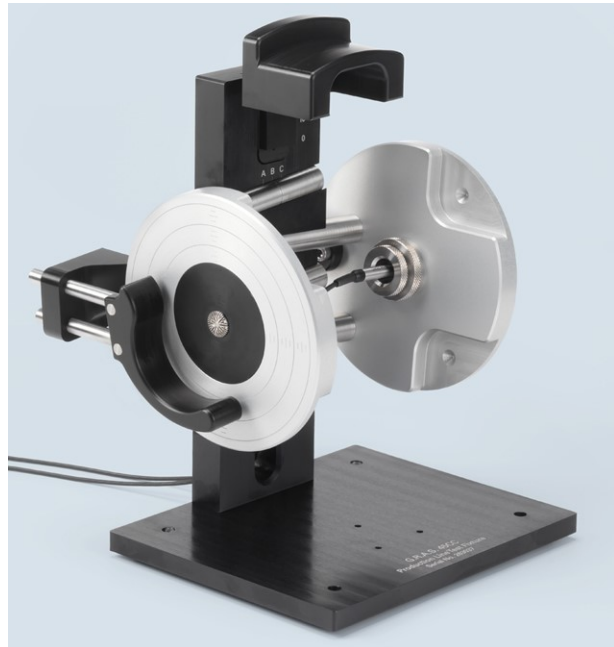
- Bandwidth: 3.15 Hz – 20 kHz
- Sensitivity: 12.5 mV/Pa
- Mic cartridge diameter: ½"

Including:

- G.R.A.S. 45CC Test Fixture
- G.R.A.S. 69CC-2 IEPE Mic Set, comprising:
  - 2x G.R.A.S. 40AO ½" IEPE Microphone
  - 2x G.R.A.S. 26CK ½" IEPE Preamplifier
  - 2x G.R.A.S. AA0070 3m BNC-Microdot cable

Optional accessories:

- By adding G.R.A.S. 44AA Mouth Simulator (Art.-No.: 2400-073) it can be modified for headset testing according the previously available complete G.R.A.S. 45CC-6 Headset Test Fixture.



Suitable for RnD and QC applications

- Recommended for QC use as defined and reproducible positioning is assured by adjustable guidance.
- Allows testing stereo earphones in one QC sequence.
- Allows testing the insertion-loss of circum-aural headphones and hearing-protectors (ear muffs). An external source is required for insertion-loss testing.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Alternatives – based on same fixture type 45CC (on request):

- G.R.A.S. 45CC-9 or 45CC-10 Headphone Test Fixture with ¼" mic cartridge diameter
  - Advantage: bandwidth increased to 70 kHz
  - Disadvantage: increased noise level due to smaller mic cartridge with reduced sensitivity
- G.R.A.S. 45CC-1 or 45CC-9 Headphone Test Fixtures with 200V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

Alternative – based on different (older) fixture type 45CA (on request):

- G.R.A.S. 45CA-1 or 45CA-2 Headphone Test Stand
  - Advantage: better inner damping for insertion-loss measurements
  - Disadvantage: defined and reproducible positioning has to be ensured by the user
  - Disadvantage: Not adjustable to different headphone sizes
- G.R.A.S. 45CA-1 Headphone Test Stand with 200 V polarized mics
  - Advantage: Slightly increased dynamic range / reduced noise floor compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

### 3.2 G.R.A.S. 45CC-4 Headphone Test Fixture with Ear Simulator

Two Channel (Stereo) Ear Simulator for On-Ear (supra-aural) and Over-Ear (circum-aural) Headphones

Item Number: 2400-081

A complete test jig for acoustical measurements on earphones in accordance with:

- IEC 60318-1
- ITU-T Rec. P.57 (08/96)

Specification:

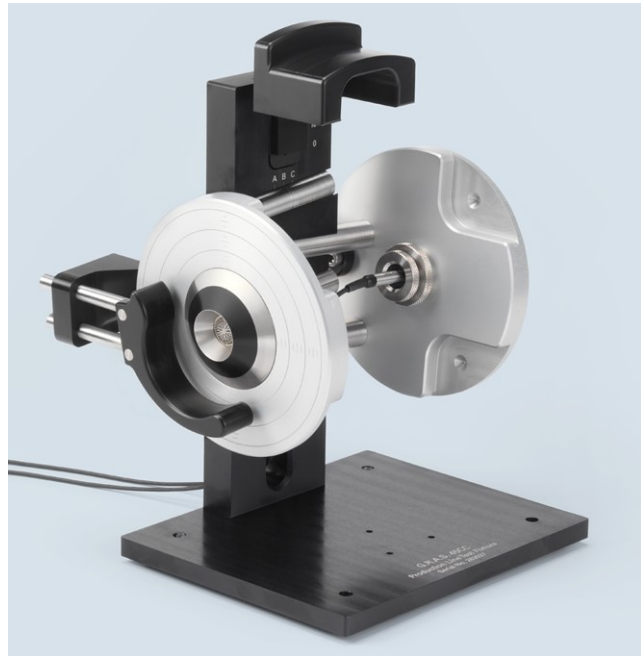
- Bandwidth:  $\leq 20$  kHz
- Sensitivity: 12.5 mV/Pa
- Mic cartridge diameter:  $\frac{1}{2}$ "

Including:

- G.R.A.S. 45CC Test Fixture
- 2x G.R.A.S. RA0039 Ear-Simulator
- G.R.A.S. 69CC-2 IEPE Mic Set, comprising:
  - 2x G.R.A.S. 40AO  $\frac{1}{2}$ " IEPE Microphone
  - 2x G.R.A.S. 26CK  $\frac{1}{2}$ " IEPE Pre-amplifier
- 2x G.R.A.S. AA0070 3m BNC-Microdot cable

Optional accessories:

- By adding G.R.A.S. 44AA Mouth Simulator (Art.-No.: 2400-073) it can be modified for headset testing according the previously available complete G.R.A.S. 45CC-8 Ear & Mouth Simulator Kit.



Suitable for RnD and QC applications

- Recommended for QC use as defined and reproducible positioning is assured by adjustable guidance.
- Allows testing stereo headphones in one QC sequence.
- Allows testing the insertion-loss of circum-aural headsets and hearing-protectors (ear muffs). An external source is required for insertion-loss testing.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Alternatives – based on same fixture type 45CC (on request):

- G.R.A.S. 45CC-3 Headphone Test Fixture with Ear Simulator Kit with 200V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

Alternative – based on different (older) fixture type 45CA (on request):

- G.R.A.S. 45CA-3 or 45CA-4 Headphone Test Stand with Ear Simulator Kit
  - Advantage: better inner damping for insertion-loss measurements
  - Disadvantage: defined and reproducible positioning has to be ensured by the user
  - Disadvantage: Not adjustable to different headphone sizes
- G.R.A.S. 45CA-3 Headphone Test Stand with Ear Simulator Kit with 200V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

### 3.3 G.R.A.S. 45CC-17 Headphone Test Fixture with Ear & Cheek Simulator and Pinna, HF Variant

Two Channel (Stereo) Ear & Cheek Simulator Kit for earphones of various types

Item Number: 2400-098



A complete test jig for acoustical measurements on earphones of various types in accordance with:

- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 3.3 Pinna Simulator

Specification:

- Bandwidth: 100 Hz to 10 kHz according to IEC 60318-4, 10 to 20 kHz:  $\pm 2.2$  dB test tolerance
- Sensitivity: 12.5 mV/Pa
- Mic cartridge diameter:  $\frac{1}{2}$ "

Including:

- 1x G.R.A.S. 45CC Test Fixture
- 2 x G.R.A.S. GR1075 Pinna Holder Plate
- 2x G.R.A.S. 69CC-8 Ear Simulator Assembly

Including:

- (2x G.R.A.S. RA0402 Ear Simulator)
  - Including:
    - (2x G.R.A.S. 40AO  $\frac{1}{2}$ " Mic)
- (2x G.R.A.S. 26CB  $\frac{1}{4}$ " IEPE Preamplifier)
- (2x G.R.A.S. RA0002  $\frac{1}{2}$ "- $\frac{1}{4}$ " adapter)
- (1x G.R.A.S. KB5010 Large Right Anthropometric Pinna)
- (1x G.R.A.S. KB5011 Large Left Anthropometric Pinna)
- (2x G.R.A.S. GR0408 Ear Canal)
- (2x G.R.A.S. GR0409 Union Nut)
- (2x G.R.A.S. AA0070 3m BNC-Microdot cable)

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Optional accessories:

- By adding G.R.A.S. 44AA Mouth Simulator (Art.-No.: 2400-073) it can be modified for headset testing.

Suitable for RnD and QC application

- Recommended for RnD use only, as frequent usage in QC application could cause wear at the pinnae. For testing the full spectrum from in-ear, on-ear and over-ear headphones and headsets this fixture can be the all-in-one solution, even for QC testing of reasonable quantities. The fixtures guidance helps to ensure a reproducible positioning of on-ear and over-ear headphones and headsets.
- Allows testing Stereo earphones in one sequence.
- Allows testing the insertion-loss of all types of headphones and hearing-protectors (ear muffs, ear buds). An external source is required for insertion-loss testing.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

Alternatives – based on same fixture type 45CC (on request):

- G.R.A.S. 45CC-14 or 45CC-15 Headphone Test Fixture with Ear & Cheek Simulator Kit and Pinna
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
- G.R.A.S. 45CC-14 or 45CC-16 Headphone Test Fixture with Pinna with 200 V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

Alternative – based on different (older) fixture type 45CA (on request):

- G.R.A.S. 45CA all variants
  - Advantage: better inner damping for insertion-loss measurements
  - Disadvantage: defined and reproducible positioning has to be ensured by the user
  - Disadvantage: Not adjustable to different headphone sizes
- G.R.A.S. 45CA-5 or 45CA-6 Headphone Test Stand with Ear & Cheek Simulator Kit and Pinna
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
  - Disadvantage: previous version without softer, anthropometric pinna
- G.R.A.S. 45CA-7 or 45CA-8 Headphone Test Stand with Ear & Cheek Simulator Kit and Antrop. Pinna
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
- G.R.A.S. 45CA-11 or 45CA-12 Headphone Test Stand with Antrop. Pinna, High Resolution variant
  - Advantage: bandwidth increased to 50 kHz
  - Disadvantage: increased noise level due to smaller mic cartridge with reduced sensitivity
- G.R.A.S. 45CA-5, 45CA-7, 45CA-9 or 45CA-11 Headphone Test Stands with 200V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs



4 Head and Torso Simulators

4.1 G.R.A.S. 45BB-14 KEMAR for Ear- and Headphone Test, HF Variant

Two Channel (Stereo) Head- & Torso Simulator Kit for earphones of various types

Item Number: 2400-093



A complete Head- & Torso Simulator for acoustical measurements on earphones of various types in accordance with:

- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 3.3  
based on ITU-T Rec. P.58
- ANSI: S3.25, S3.36

Specification:

- Bandwidth: 100 Hz to 10 kHz according to IEC 60318-4, 10 to 20 kHz:  $\pm 2.2$  dB test tolerance
- Sensitivity: 12.5 mV/Pa
- Mic cartridge diameter:  $\frac{1}{2}$ "

Including:

- 1x G.R.A.S. 45BB KEMAR Head & Torso
- 2x G.R.A.S. RA0402 Ear Simulator  
(2x G.R.A.S. 40AO Mic incl. in RA0402)
- 2x G.R.A.S. 26CS ¼" IEPE Preamplifier
- 2x G.R.A.S. GR1874 Ear Simulator Holder
- 2x G.R.A.S. GR0408 External Ear Canal
- 2x G.R.A.S. GR0409 Union Nut
- 1x G.R.A.S. KB5000 Large Right Anthropometric Pinna, Shore 35-00
- 1x G.R.A.S. KB5001 Large Left Anthropometric Pinna, Shore 35-00  
(Optional non-anthropometric, small, softer Shore 55-00 or VA-style Ears available)
- 2x G.R.A.S. RA0001 Right-angled Adapter
- 2x G.R.A.S. AA0018-S Microdot-BNC cable 35cm (inside KEMAR)
- 2x G.R.A.S. AA0035 BNC-BNC cable 3m

Suitable for RnD and QC application

- Recommended for RnD use only, as defined and reproducible positioning of the DUT has to be ensured by the user. A reproducible position on the head simulator is more complicated as on a test fixture with guidance.
- With head and torso simulator more human like testing is possible compared to test stands. E.g. for most realistic ANC testing.
- Allows testing Stereo earphones in one sequence.
- Allows testing the insertion-loss of all types of headphones and hearing-protectors (ear muffs). An external source is required for insertion-loss testing.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

Alternatives – based on same fixture type 45BB (on request):

- G.R.A.S. 45BB-5 or 45BB-6 KEMAR for Ear- and Headphone Test
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
  - Disadvantage: previous version without softer, anthropometric pinna
- G.R.A.S. 45BB-9 or 45BB-10 KEMAR for Ear- and Headphone Test with Anthropometric Pinnae
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
- G.R.A.S. 45BB-11 or 45BB-12 KEMAR for Ear- and Headphone Test, Low Noise variant
  - Advantage: lowest possible noise floor
  - Disadvantage: bandwidth reduced to 10 kHz
- G.R.A.S. 45BB-15 or 45BB-16 KEMAR for Ear- and Headphone Test, High Resolution variant
  - Advantage: bandwidth increased to 50 kHz
  - Disadvantage: increased noise level due to smaller mic cartridge with reduced sensitivity
- G.R.A.S. 45BB-1 or 45BB-2 KEMAR for Hearing Aid Test, 1-channel
  - Disadvantage: not recommended for standardized headphone tests
  - Disadvantage: not suitable for stereo headphone tests
- G.R.A.S. 45BB-7 or 45BB-8 KEMAR for Hearing Aid Test, 2-channel
  - Disadvantage: not recommended for standardized headphone tests
- G.R.A.S. 45BB-3 or 45BB-4 KEMAR for Sound Quality Recording
  - Disadvantage: no ear canal simulator, not recommended for headphone testing
- G.R.A.S. 45BB-1, 45BB-3, 45BB-5, 45BB-7, 45BB-9, 45BB-11, 45BB-13 or 45BB-15 KEMAR with 200 V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

**4.2 G.R.A.S. 45BC-14 KEMAR for Headset Test, HF Variant**

**Two Channel (Stereo) Head- & Torso Simulator Kit with Mouth Simulator for headsets of various types**

**Item Number: 2400-092**



A complete Head- & Torso Simulator for acoustical measurements on earphones of various types in accordance with:

- IEC 60318-4 (former IEC 60711)
- ITU-T Rec. P.57 Type 3.3  
based on ITU-T Rec. P.58
- ANSI: S3.25, S3.36

Specification:

- Bandwidth: 100 Hz to 10 kHz according to IEC 60318-4, 10 to 20 kHz:  $\pm 2.2$  dB test tolerance
- Sensitivity: 12.5 mV/Pa
- Mic cartridge diameter: 1/2"
- Active sound source according G.R.A.S 44AA specification

### Including:

- 1x G.R.A.S. 45BC KEMAR Head & Torso (Incl. Mouth Simulator with G.R.A.S. AB0012 power supply)
- 2x G.R.A.S. RA0402 Ear Simulator  
(2x G.R.A.S. 40AO Mic incl. in RA0402)
- 2x G.R.A.S. 26CS ¼" IEPE Preamplifier
- 2x G.R.A.S. GR1874 Ear Simulator Holder
- 2x G.R.A.S. GR0408 External Ear Canal
- 2x G.R.A.S. GR0409 Union Nut
- 1x G.R.A.S. KB5000 Large Right Anthropometric Pinna, Shore 35-00
- 1x G.R.A.S. KB5001 Large Left Anthropometric Pinna, Shore 35-00  
(Optional non-anthropometric, small, softer Shore 55-00 or VA-style Ears available)
- 2x G.R.A.S. RA0001 Right-angled Adapter
- 2x G.R.A.S. AA0018-S Microdot-BNC cable 35cm (inside KEMAR)
- 1x G.R.A.S. AA0070 Microdot-BNC cable 3m (for calibration of the Mouth)
- 3x G.R.A.S. AA0035 BNC-BNC cable 3m (2x Ear, 1x Mouth)
- 1x Adapter; XLR female - BNC female for Mouth Simulator

### Suitable for RnD and QC application

- Recommended for RnD use only, as defined and reproducible positioning of the DUT has to be ensured by the user. A reproducible position on the head simulator is more complicated as on a test fixture with guidance.
- With head and torso simulator more human like testing is possible compared to test stands. E.g. for most realistic ANC and headset testing.
- Allows testing Stereo earphones in one sequence.
- Allows testing the insertion-loss of all types of headphones and hearing-protectors (ear muffs). An external source is required for insertion-loss testing.
- The IEPE powered version can be connected directly to analyzer Mic input without additional accessories.

For more information see [manufacture website](#). A detailed manual and specifications for all included components is available.

### Alternatives – based on same fixture type 45BB (on request):

- G.R.A.S. 45BC-1 or 45BC-1 KEMAR for Headset Test
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
  - Disadvantage: previous version without softer, anthropometric pinna
- G.R.A.S. 45BC-9 or 45BC-10 KEMAR for Headset Test with Anthropometric Pinnae
  - No Advantage: as newer version fulfills same standards
  - Disadvantage: previous version with bandwidth limitation to 10 kHz
- G.R.A.S. 45BC-11 or 45BC-12 KEMAR for Headset Test, Low Noise variant
  - Advantage: lowest possible noise floor
  - Disadvantage: bandwidth reduced to 10 kHz
- G.R.A.S. 45BC-15 or 45BC-16 KEMAR for Headset Test, High Resolution variant
  - Advantage: bandwidth increased to 50 kHz
  - Disadvantage: increased noise level due to smaller mic cartridge with reduced sensitivity
- G.R.A.S. 45BC-3 or 45BC-4 KEMAR for Telephone Test, 1-channel
  - Disadvantage: not recommended for standardized headphone tests
  - Disadvantage: not suitable for stereo headphone tests
- G.R.A.S. 45BC-1, 45BC-3, 45BC-5, 45BC-9, 45BC-11, 45BC-13 or 45BC-15 KEMAR with 200 V polarized mics
  - Advantage: Slightly increased dynamic range compared to IEPE variant
  - Disadvantage: requires external 200 V mic supply unit, causes extra costs

## 5 Mouth Simulators

### 5.1 G.R.A.S. 44AA Mouth Simulator, according to ITU-T Rec. P51 Set

Article Number: 2400-073

See specification [A15 Sound Sources](#).

### 5.2 G.R.A.S. 44AB Mouth Simulator, according to ITU-T Rec. P51 Set

Article Number: 2400-077

See specification [A15 Sound Sources](#).

## 6 Add-Ons

Add-on packages are available on request to modify an existing simulator or test fixture to another variant. Some add-ons require an additional microphone cartridge as it has to be calibrated to its related coupler and should not be removed from the coupler. For a permanent modification the add-ons are recommended. For alternating usage an additional simulator kit will be the better choice in most cases.

Find explanations for symbols at:

<http://www.klippel.de/know-how/literature.html>

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